WHAT IS CLAIMED IS:

1. A stepping motor comprising:

a permanent magnet type rotor with a plurality of poles secured to a rotating shaft and a stator having stator magnetic poles with stator magnetic pole teeth in which excitation windings are wound on a plurality of magnetic poles in a star or delta connection,

wherein the rotor is magnetized in different directions alternately circumferentially to satisfy the following equation: $M = 4F / 3$ where M is the number of poles of the rotor and F is the number of the stator magnetic poles,

the rotor is cylindrical in shape with the stator rotatably disposed inside, disposed opposing the surfaces of the stator magnetic pole teeth through an air gap which is of a uniform dimension throughout the circumference between the surfaces of the stator magnetic pole teeth of the stator and the rotor,

and the surface magnetic flux distribution thereof has a substantially sinusoidal wave form circumferentially.

2. A stepping motor according to claim 1, further comprising a cylindrical bearing holder for securing the rotating shaft in a predetermined location in an enclosure, the bearing holder vertically mounted by caulking to a base on which the stepping motor is mounted,

wherein the rotor is disposed opposing the outside of the stator through the air gap which is of a uniform dimension throughout the circumference between the rotor and the stator magnetic pole teeth surfaces and secured to the rotating shaft rotatably provided by a pair of bearings opposing one another through the bearing holder.

3. A stepping motor according to claim 2, wherein the bearing holder has an arc-shaped deformation preventing groove to prevent deformation due to the caulking.

4. A stepping motor according to any one of claims 1 to 3, wherein the arc-shaped deformation preventing groove is provided along the circumference at

the side end contacting the base to which the stepping motor is mounted.

5. A stepping motor according to any one of claims 1 to 4, wherein the rotor is provided opposing the stator magnetic poles on a rotor yoke secured to the rotating shaft and a notch is provided in the rotor yoke in order to leak magnetism of the rotor,
further comprising a leakage flux detector for detecting leaking magnetic flux from the rotor, the leakage flux detector provided in a position opposing the notch.

6. A stepping motor according to any one of claims 1 to 5, further comprising a leakage flux detector for detecting changes in magnetic poles, the leakage flux detector provided on a cylinder end surface of a cylindrical permanent magnet provided in a cylindrical shape opposing the stator magnetic poles on the rotor yoke secured to the rotating shaft.

7. A stepping motor according to claim 5 or 6, further comprising a rotary polygon mirror secured to the rotating shaft which is rotatably provided through the cylindrical bearing holder vertically mounted on the base to which the stepping motor is mounted, which rotates along with the rotating shaft, the rotary polygon mirror provided on the outer periphery of the rotor yoke with each mirror surface corresponding to a magnetic pole of the rotor of the stepping motor.

8. A stepping motor device comprising:

a stepping motor including

a permanent magnet type rotor with a plurality of poles secured to a rotating shaft,

a stator having stator magnetic poles with stator magnetic pole teeth in which excitation windings are wound on a plurality of magnetic poles in a star or delta connection, and

a rotary polygon mirror provided on the outer periphery of a rotor yoke rotatable along with the rotating shaft with each mirror surface corresponding to a magnetic pole of the rotor,

wherein the rotor is magnetized in different directions

alternately circumferentially to satisfy the following equation: $M = 4F / 3$ where M is the number of poles of the rotor and F is the number of the stator magnetic poles,

the rotor is cylindrical in shape with the stator rotatably disposed inside, disposed opposing the surfaces of the stator magnetic pole teeth through an air gap which is of a uniform dimension throughout the circumference between the surfaces of the stator magnetic pole teeth of the stator and the rotor, and

the surface magnetic flux distribution thereof has a substantially sinusoidal wave form circumferentially;

a leakage flux detector for detecting changes in magnetic poles provided on a cylindrical end surface of the rotor of the stepping motor;

a driving means to control rotation of the stepping motor by impressing a driving signal in a three-phase single-two-phase excitation mode to three excitation feeding terminals in a star or delta connection wound on a plurality of magnetic poles of the stepping motor; and

a means to detect the position of the rotary polygon mirror by a signal from the leakage flux detector.

9. A stepping motor device comprising:

a stepping motor including a permanent magnet type rotor with a plurality of poles secured to a rotating shaft, and

a stator having stator magnetic poles with stator magnetic pole teeth in which excitation windings are wound around a plurality of magnetic poles in a star or delta connection,

wherein the rotor is magnetized in different directions alternately circumferentially to satisfy the following equation: $M = 4F / 3$ where M is the number of poles of the rotor and F is the number of the stator magnetic poles,

the rotor is cylindrical in shape with the stator rotatably disposed inside, disposed opposing the surfaces of the stator magnetic pole teeth through an air gap which is of a uniform dimension throughout the circumference between the surfaces of the stator magnetic pole teeth of the stator and the rotor, and

the surface magnetic flux distribution thereof has a

substantially sinusoidal wave form circumferentially;

a driving means to impress a driving signal in a three-phase single-two-phase excitation mode to three excitation feeding terminals and to control rotation of the stepping motor by a signal from a leakage flux detector for detecting magnetic flux leaking from a notch provided in a rotor yoke; and

a means to repeat the processing to control the rotation a predetermined number of times and to issue a warning when normal rotation is not obtained.

10. A method of driving a stepping motor, the stepping motor including a permanent magnet type rotor with a plurality of poles secured to a rotating shaft and a stator having stator magnetic poles with stator magnetic pole teeth in which excitation windings are wound around a plurality of magnetic poles in a star or delta connection, wherein the rotor is magnetized in different directions alternately circumferentially to satisfy the following equation: $M = 4F / 3$ where M is the number of poles of the rotor and F is the number of the stator magnetic poles, the rotor is cylindrical in shape with the stator rotatably disposed inside, disposed opposing the surfaces of the stator magnetic pole teeth through an air gap which is of a uniform dimension throughout the circumference between the surfaces of the stator magnetic pole teeth of the stator and the rotor, and the surface magnetic flux distribution thereof has a substantially sinusoidal wave form circumferentially; and a driving means to impress a driving signal in a three-phase single-two-phase excitation mode to three excitation feeding terminals and to control rotation of the stepping motor by a signal from a leakage flux detector which detects magnetic flux leaking from a notch provided in a rotor yoke,

the method comprising the steps of:

driving the stepping motor by impressing the driving signal in the three-phase single-two-phase excitation mode to the three excitation feeding terminals in a star or delta connection wound on a plurality of magnetic poles of the stepping motor,

detecting the signal from the leakage flux detector and comparing the changing speed of the signal of the leakage flux detector with the driving signal of the stepping motor,

stopping supply of the driving signal of the stepping motor in case of a difference equal to or greater than a certain value in the comparison results,

supplying the driving signals again after a predetermined time,

repeating stopping and supplying processes of the driving signal for a predetermined number of times; and

issuing a warning when normal rotation is not obtained.